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QUANTUM CHAOS IN RYDBERG ATOMS  
January 1, 1996- December 31, 1996  
Daniel Kleppner, Principal Investigator

ANNUAL TECHNICAL REPORT

During this year we have demonstrated a new experimental technique for studying the interface of classical and quantum dynamics, based on our previous work in recurrence spectroscopy. The subject is a lithium atom in an applied electric field, and the starting point is the recurrence spectrum in various energy regimes. We selected a particularly simple regime where a single classical orbit, and its repetitions, is manifest in the recurrence spectrum. In our new method, the system is perturbed with an oscillating electric field whose frequency is varied in the vicinity of the frequency of the primary classical orbit. We have been able to do this under conditions of scaled energy spectroscopy, in which the static and oscillating field amplitudes, the frequency, and the laser energy are all varied simultaneously so as to maintain conditions of constant classical dynamics. We have observed the creation and destruction of orbits by our field, and the systematic perturbation of the action of various orbits. In collaboration with Prof. John Delos of the College of William and Mary, a theoretical framework has been constructed which appears capable of providing a good quantitative description of the phenomena.

This work has not yet been published, but a submission to Physical Review Letters is under preparation, to be followed by other papers.

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